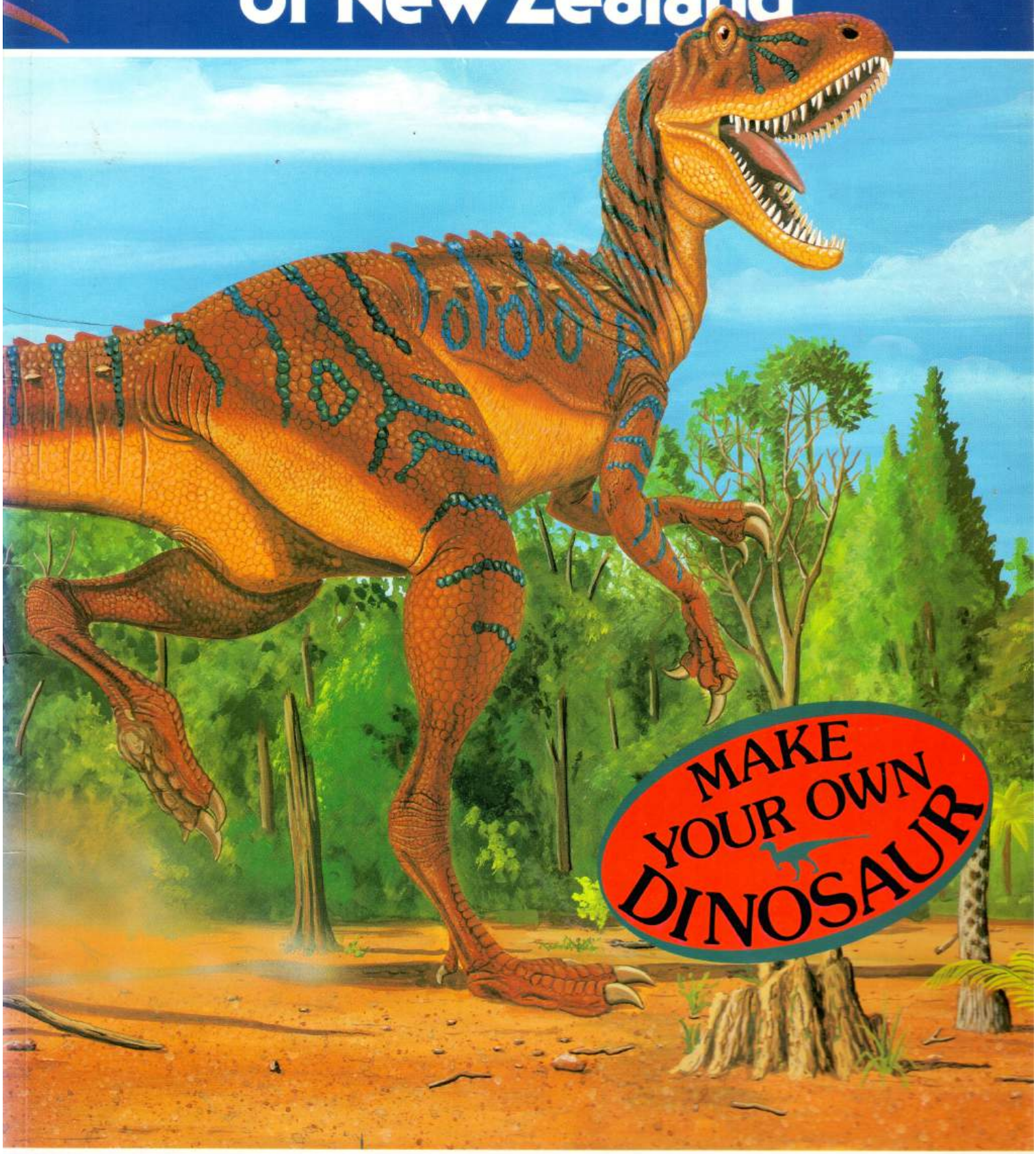
DINOSAURS of New Zealand

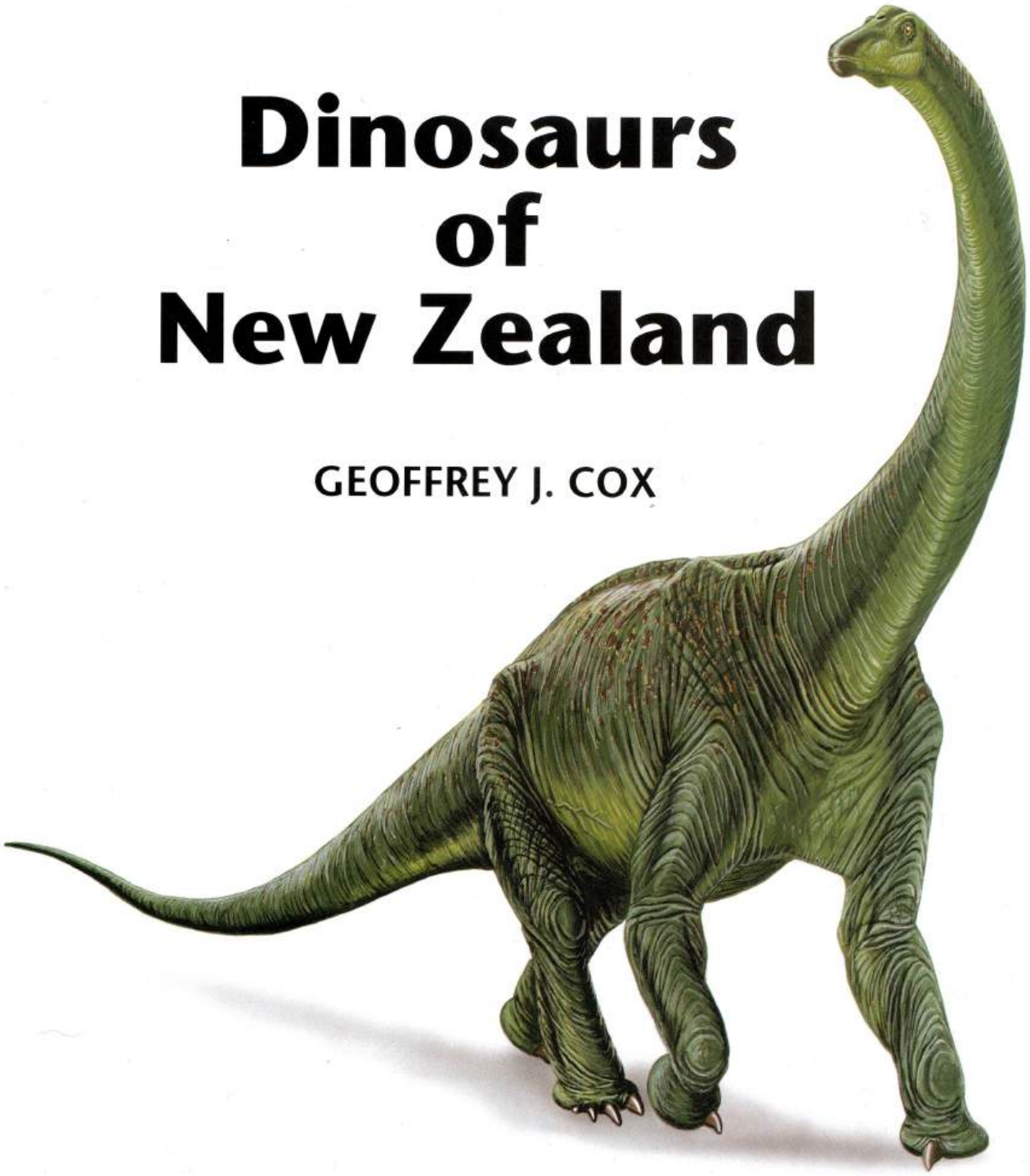


Geoffrey J. Cox

Stewart

Dinosaurs of New Zealand

GEOFFREY J. COX



VIKING PACIFIC

My warmest thanks are due to Joan Wiffen, who not only read and commented upon the text of this book, but who also gave me a preview of her latest dinosaur finds. I would also like to thank my wife, Barbara Hochstein, for her comments on my paintings, and Christine Moffat of Penguin Books, for her enthusiasm and advice.

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Seventy million years ago

Seventy million years ago, the world was very different to today. You would not recognise a map of it, for the continents were in totally different places. Some, like Australia and Antarctica, were joined together to make a single giant continent, while others, like Africa and India, which are both joined to Europe and Asia today, were vast islands, surrounded by sea.

If you had walked on these lands, you would have found some animals — insects, birds and lizards — that were very familiar to you, but most would have been completely different. But you would probably have recognised the forest. In those days, the most important forest trees were a type known as podocarps. Today, over almost the entire world, these have been replaced by more advanced trees, but in New Zealand they have remained. In our native forests, the rimu, totara, miro, kahikatea and matai are all podocarps. The kauri is even more ancient, and beech trees and tree ferns date from this time as well. The New Zealand forest is one of the most ancient on earth.

In fact, New Zealand has changed much less than most of the rest of the world in the past 70 million years. Then, as now, it was made up of a group of islands. Its climate was similar to that of today. In the forests there were tuatara, frogs and lizards, and the ancestors of the saddleback and rifleman, and probably of the kiwi.

But some things were totally different. In the coastal waters swam huge marine reptiles, while in the forests and swamps of the land were dinosaurs.

Fossil bones

We know this because, for over 150 years, scientists have been finding fossils of these animals. In 1859, a man called Thomas Hood found the first fossil bones of a giant reptile in the Waipara River in the South Island. He sent the bones to England, where they were examined by one of the most brilliant specialists in fossils to have ever lived: Sir Richard Owen. He recognised the bones as those of a long-necked marine reptile called a plesiosaur [PLE-see-uh-SAW].

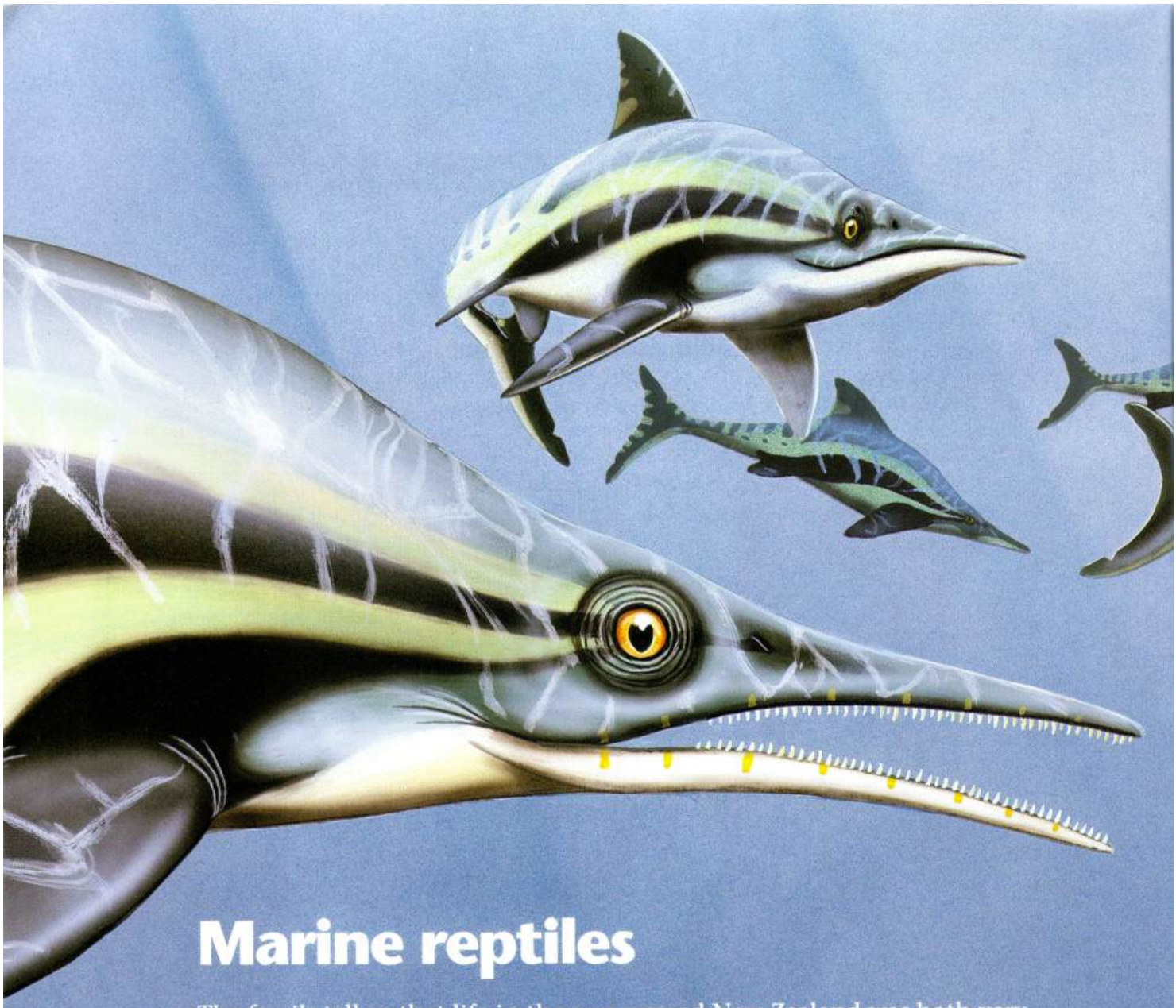
Over the next ten years, more and more bones were collected from the Waipara River bed, not only by Hood but also by Julius von Haast, founder of the museum in Christchurch, and James Hector, who founded the museum in Wellington.

Soon, fossils were being collected from other sites in the South Island. Much later on, they were discovered in the North Island too. They are still being found today.

Although many of the bones are broken into fragments, it is normally possible to put them back together again. Even when most of the skeleton is missing (it usually is), palaeontologists [PAL-ae-on-TOL-o-jists] — people who study fossil animals — can work out what the animal looked like by comparing the remains with those of other animals of the same type, both in New Zealand and from overseas.

Human giants?

- In France in 1770, workers in a chalk mine found prehistoric reptile remains.
- A human giant? The remains of a giant whale? Many people did not believe that animals could become extinct.
- The remains were correctly identified in the 1790s as the jaws of a giant marine lizard.
- The discovery of fossils such as this proved that many animals that once lived on the world had now died out.



Marine reptiles

The fossils tell us that life in the seas around New Zealand was both very similar and completely different to the seas around the country today. In the sand and on the rocks lived shellfish that looked just the same as the ones you find today. Most of the fish, too, were more or less like modern ones. There were no octopuses or squids, but there were animals called belemnites, which must have appeared very similar to squid. There were also strange creatures called ammonites, which looked like squids living in spiral shells.

However, some creatures were very different to modern sea animals.The most spectacular were the huge marine reptiles. There was one type that was the reptile version of modern dolphins and whales.

Just as dolphins and whales are descended from a land mammal that returned to the sea, so these animals, called ichthyosaurs [ik-THEE-uh-SAWS] — which means 'fish-lizard' — came from land reptiles. Like dolphins, they had a long, streamlined body, with a dorsal fin on the back. Unlike dolphins, both the front and back legs had turned into flippers, and the tail was vertical, not horizontal.

Most reptiles lay eggs, but ichthyosaurs could not leave the water, so their young were born alive. What is more, just like dolphins, they were born tail first so that they would not drown.

Most ichthyosaurs we know of were two to three metres long, just like modern dolphins, but some were much larger — real reptile whales! The biggest in the world seems to have been one discovered in New Zealand in 1877 by James Hector. Although only a few vertebrae and some ribs were discovered, the measurements suggest that the animal must have been about twenty metres long! Unfortunately, the fossils have been lost, so we will never know for sure how big it was. In fact, we cannot even prove that it ever existed — Hector may have made a mistake.

An important fossil collector

- Mary Anning lived on the south coast of England.
- In 1811, when she was just eleven years old, Mary found her first ichthyosaur skeleton.
- In 1824, she found the first complete plesiosaur skeleton.
- In 1828, she found the first English pterosaur skeleton.
- Geologists walked the cliffs with Mary, watching as she discovered fossils.

Ichthyosaurs looked very similar to modern sharks or dolphins, plesiosaurs, on the other hand, looked exactly like most people's idea of a real sea monster. They had round bodies with strong, paddle-like flippers, a short tail and a long neck. In some plesiosaurs, the neck was much longer than the rest of the body and tail combined.

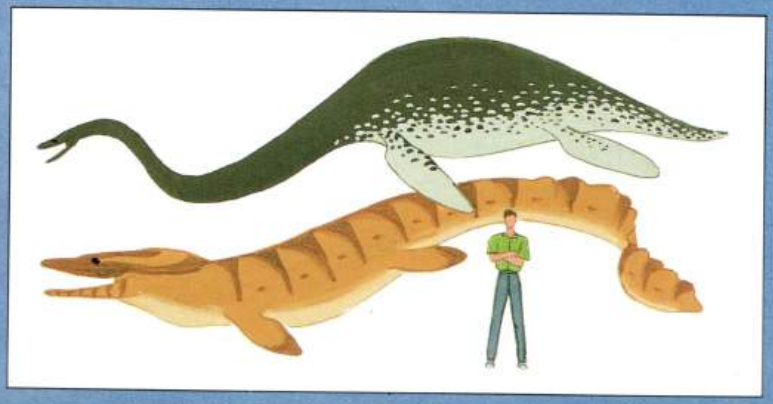
Plesiosaurs could not swim very fast, and we think they moved through the water at the surface, with heads held high, watching out for fish ahead of them, which they caught with a sudden plunge. Like modern turtles, they probably dragged themselves out onto beaches to lay their eggs in the sand. Several kinds are known from New Zealand seas, the largest being one called *Mauisaurus* [MAO-ee-SAW-rus], which was nine metres long. Most of the other species were six to eight metres long.

Perhaps the most fearsome marine reptiles in New Zealand seas were the mosasaurs [MOW-za-SAWS]. In many ways, these were rather like huge crocodiles — they had massive jaws armed with many sharp teeth, long bodies, and big tails, flattened from side to side, which they used to swim. Both their front and hind legs had turned into flippers — if they ever came out onto land, they must have been very awkward. They were related to the lizards but were of giant size: those in New Zealand were among the biggest known, reaching eight metres or more in length, with skulls over a metre long.

Mosasaurs would have fed on much larger prey than plesiosaurs — big fish, turtles, and perhaps even plesiosaurs themselves.

The longest plesiosaur

- The longest plesiosaur was discovered in 1868 in America.
- *Elasmosaurus* [ee-LAZ-mo-SAW-rus] had a neck that measured over half its total length of 14 metres.
- The palaeontologist who found *Elasmosaurus* could not believe the neck was so long, and put the head on the tail instead!
- The neck contained 76 vertebrae — more than any other animal (a giraffe has seven vertebrae).



An Important Discovery

Although, over the 150 years from the discovery of the first plesiosaur, many fossils of marine reptiles were found, no one found any dinosaurs. Many scientists argued that this was because New Zealand never had any of these creatures. They said that it was too small or too cold for dinosaurs to live here, or that it was too difficult for them to get here in the first place.

Then, in 1979, a woman called Joan Wiffen, who collected marine reptile fossils from a riverbed in Hawke's Bay, found a strange bone. It was a broken vertebra (part of the backbone), but it was not like that of . . .

a mosasaur

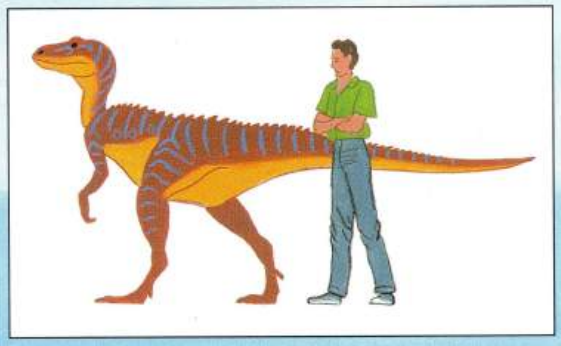
or a plesiosaur

or an ichthyosaur.

She showed it to an Australian palaeontologist called Ralph Molnar, and he identified it as coming from the tail of . . .

The discovery of dinosaurs

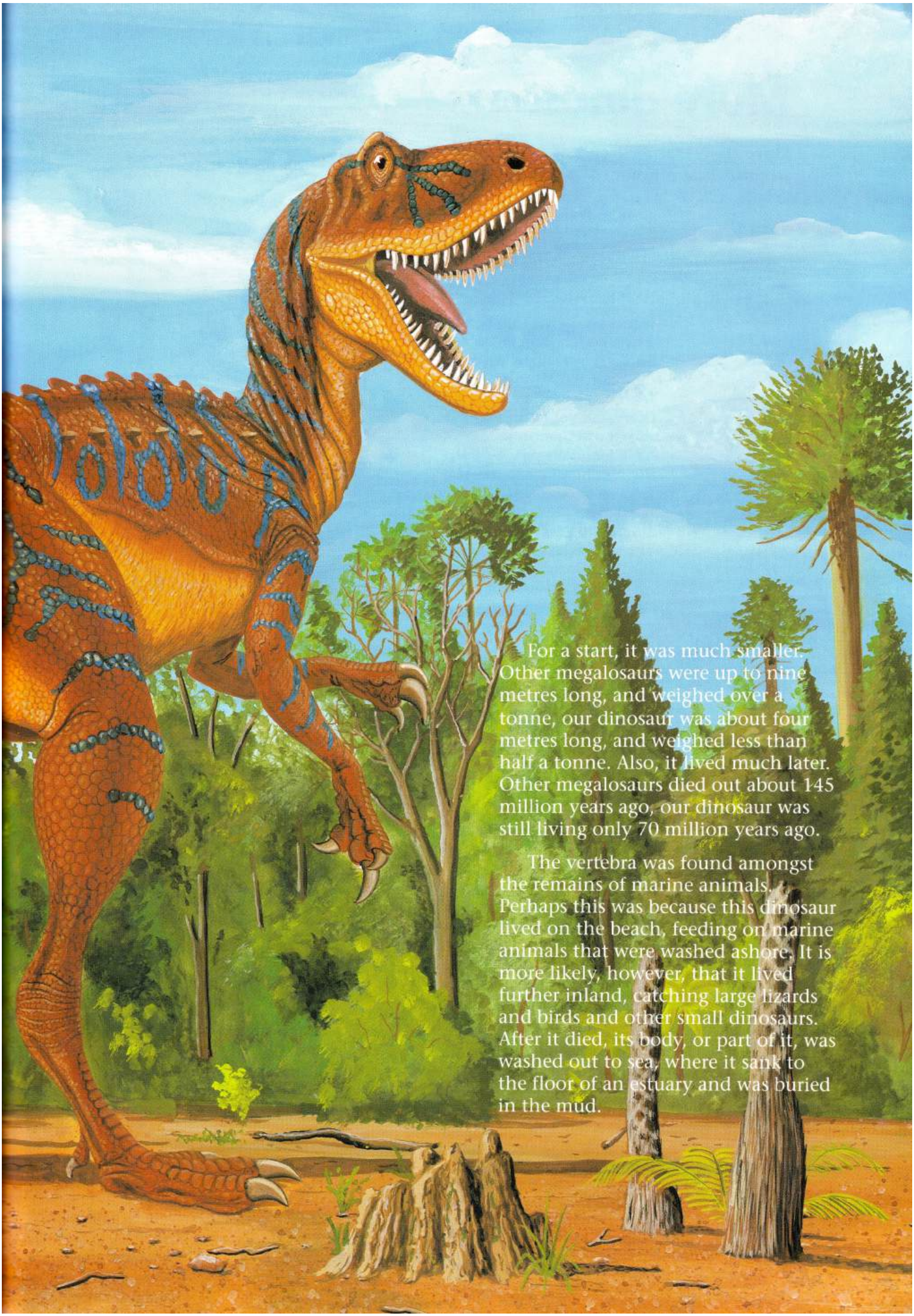
- Although dinosaur remains had been found before, no one understood what they were.
- But in 1822, Mary Ann Mantell, an English doctor's wife, found some huge teeth in a pile of stones by the roadside.
- Her husband, Gideon, thought the teeth looked like those of a South American iguana lizard, so he called the animal they came from *Iguanadon* [ih-GWAN-oh-DON] (= iguana tooth).
- He suggested that many 'giant lizards' had once lived in the world.
- In 1841, they were given the name dinosaur (= terrible lizard).
- Walter Mantell, the son of Mary Ann and Gideon, emigrated to New Zealand. He became a government surveyor and, during the 1840s, was a major discoverer of moa bones.



. . . a dinosaur!

Although the little bone is broken, we can tell what it must have looked like. Vertebrae like this came from only one type of dinosaur that we know of: a meat-eating kind called *Megalosaurus* [MEG-a-low-SAW-rus]. This dinosaur lived in what is now Europe and, back in 1818 in England, was, by a strange coincidence, the first dinosaur remain ever discovered anywhere in the world.

We can guess that New Zealand's megalosaur, like its northern cousin, walked on its hind legs, had powerful, clawed hands, and a big head with fearsome teeth. But even though we have only one bone, we can tell that in other ways our dinosaur was very different.

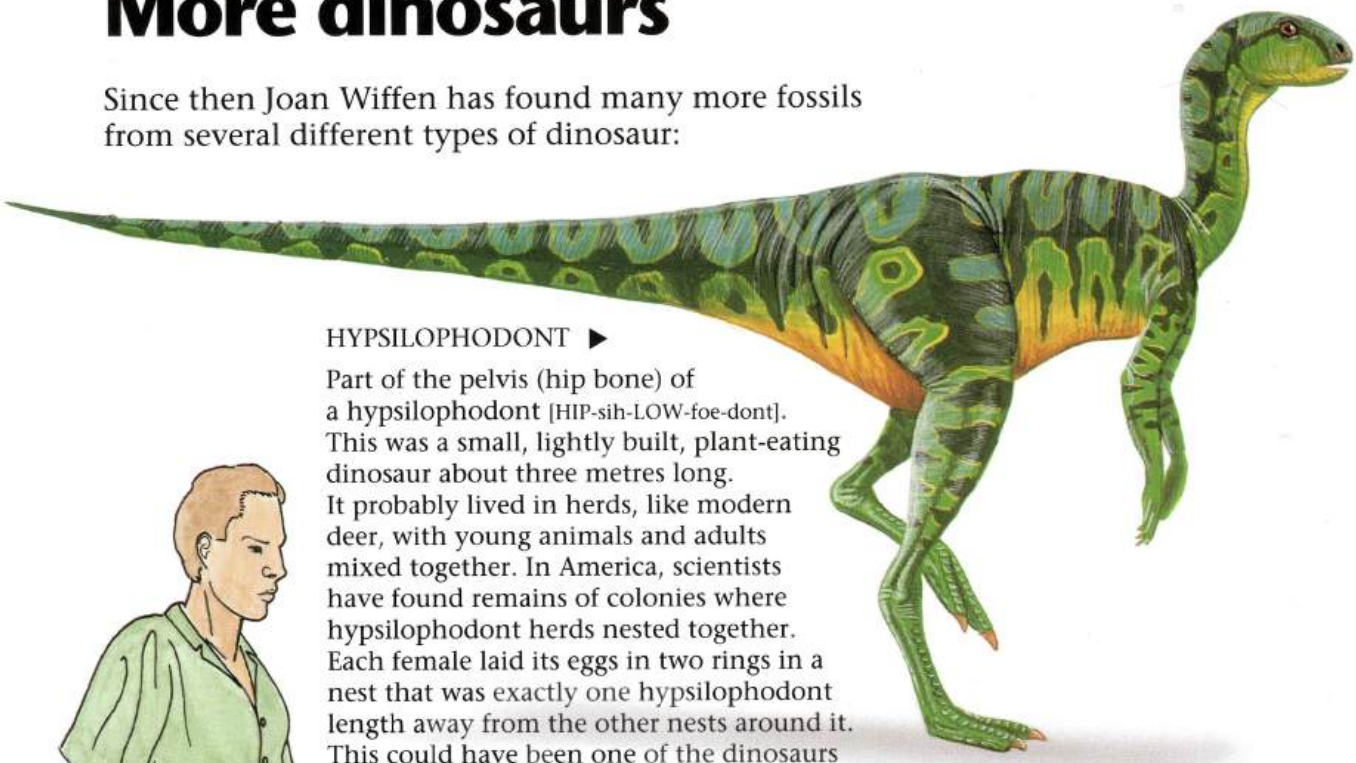


For a start, it was much smaller. Other megalosaurs were up to nine metres long, and weighed over a tonne, our dinosaur was about four metres long, and weighed less than half a tonne. Also, it lived much later. Other megalosaurs died out about 145 million years ago, our dinosaur was still living only 70 million years ago.

The vertebra was found amongst the remains of marine animals. Perhaps this was because this dinosaur lived on the beach, feeding on marine animals that were washed ashore. It is more likely, however, that it lived further inland, catching large lizards and birds and other small dinosaurs. After it died, its body, or part of it, was washed out to sea, where it sank to the floor of an estuary and was buried in the mud.

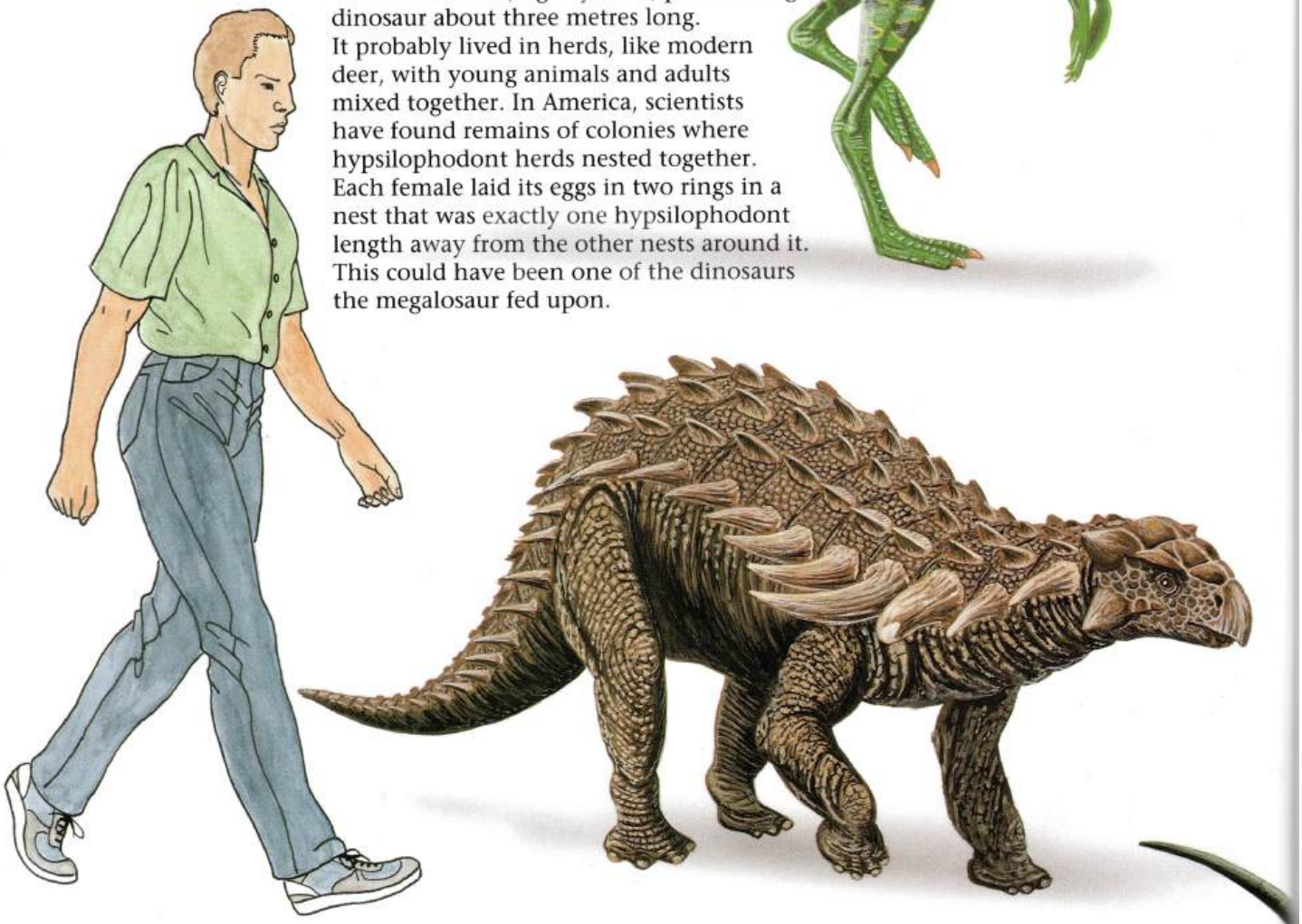
More dinosaurs

Since then Joan Wiffen has found many more fossils from several different types of dinosaur:



HYPSILOPHODONT ▶

Part of the pelvis (hip bone) of a hypsilophodont [HIP-sih-LOW-foe-dont]. This was a small, lightly built, plant-eating dinosaur about three metres long. It probably lived in herds, like modern deer, with young animals and adults mixed together. In America, scientists have found remains of colonies where hypsilophodont herds nested together. Each female laid its eggs in two rings in a nest that was exactly one hypsilophodont length away from the other nests around it. This could have been one of the dinosaurs the megalosaur fed upon.



ANKYLOSAUR ▲

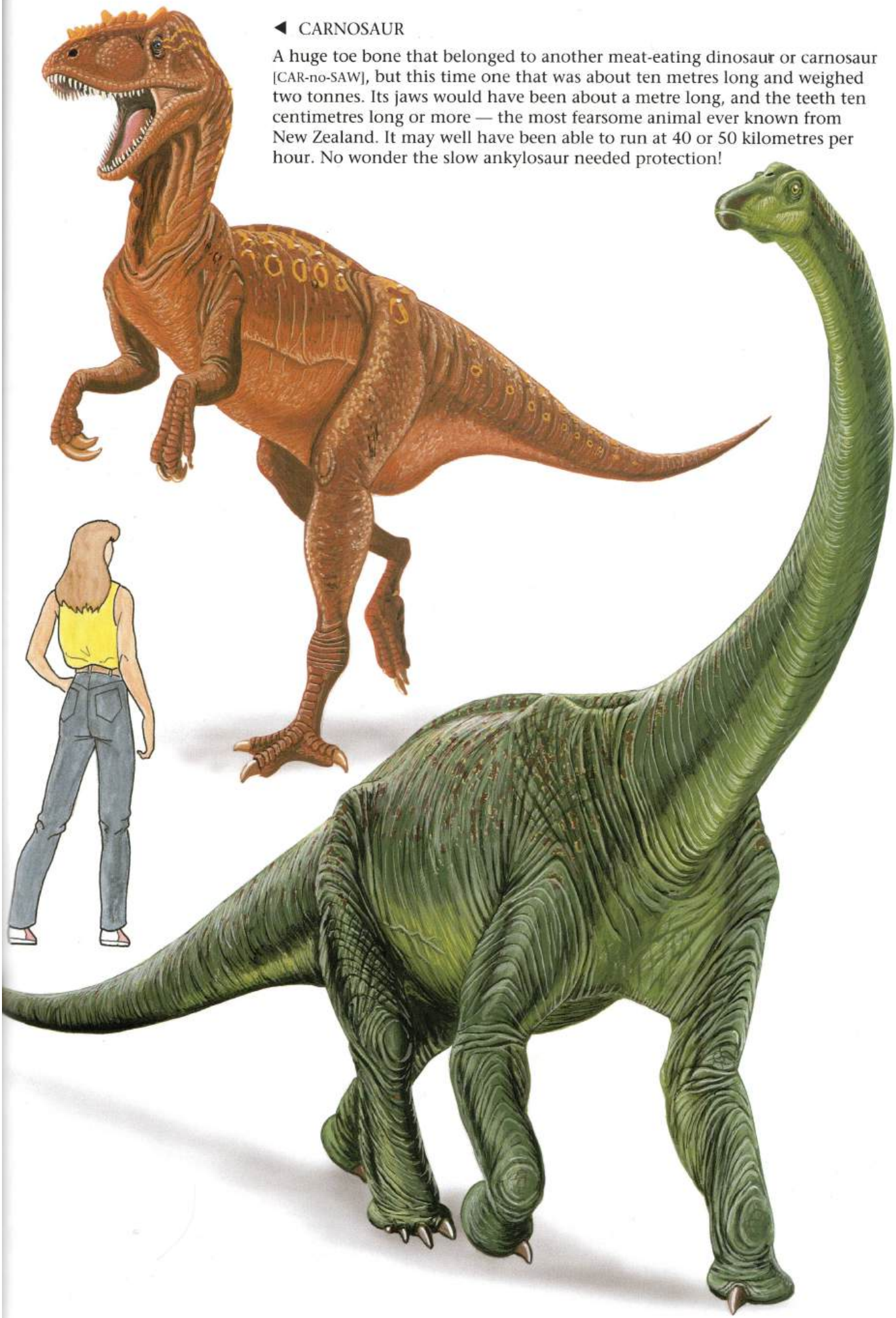
A piece of curiously flattened rib and two tail vertebrae that must have belonged to an armoured dinosaur called an ankylosaur [an-KEE-low-SAW], about two and a half to three metres long and weighing about half a tonne. Ankylosaurs were built like living tanks, with heavy shields and horns of bone set into the skin of their backs and covering their heads. Some had a great club of solid bone on the end of the tail, although we do not think the New Zealand one did.

SAUROPOD ▶

A piece of a rib that must have originally been about a metre long. This belonged to a sauropod [SAW-row-POD] — one of the giant long-necked, long-tailed plant-eaters that included such well-known dinosaurs as *Apatosaurus* [a-PAT-oh-SAW-rus] — also called *Brontosaurus* [BRON-tuh-SAW-rus] and *Diplodocus* [die-PLOH-dah-cus]. Ours was smaller than these giants but, with a body as large or larger than a big elephant, was still the biggest animal ever known from New Zealand. It roamed through the forest, using its long neck to browse off trees like a weird giraffe. Like an elephant, it probably could rear up on its hind legs to reach even higher.

◀ CARNOSAUR

A huge toe bone that belonged to another meat-eating dinosaur or carnosaur [CAR-no-SAW], but this time one that was about ten metres long and weighed two tonnes. Its jaws would have been about a metre long, and the teeth ten centimetres long or more — the most fearsome animal ever known from New Zealand. It may well have been able to run at 40 or 50 kilometres per hour. No wonder the slow ankylosaur needed protection!



Flying reptiles

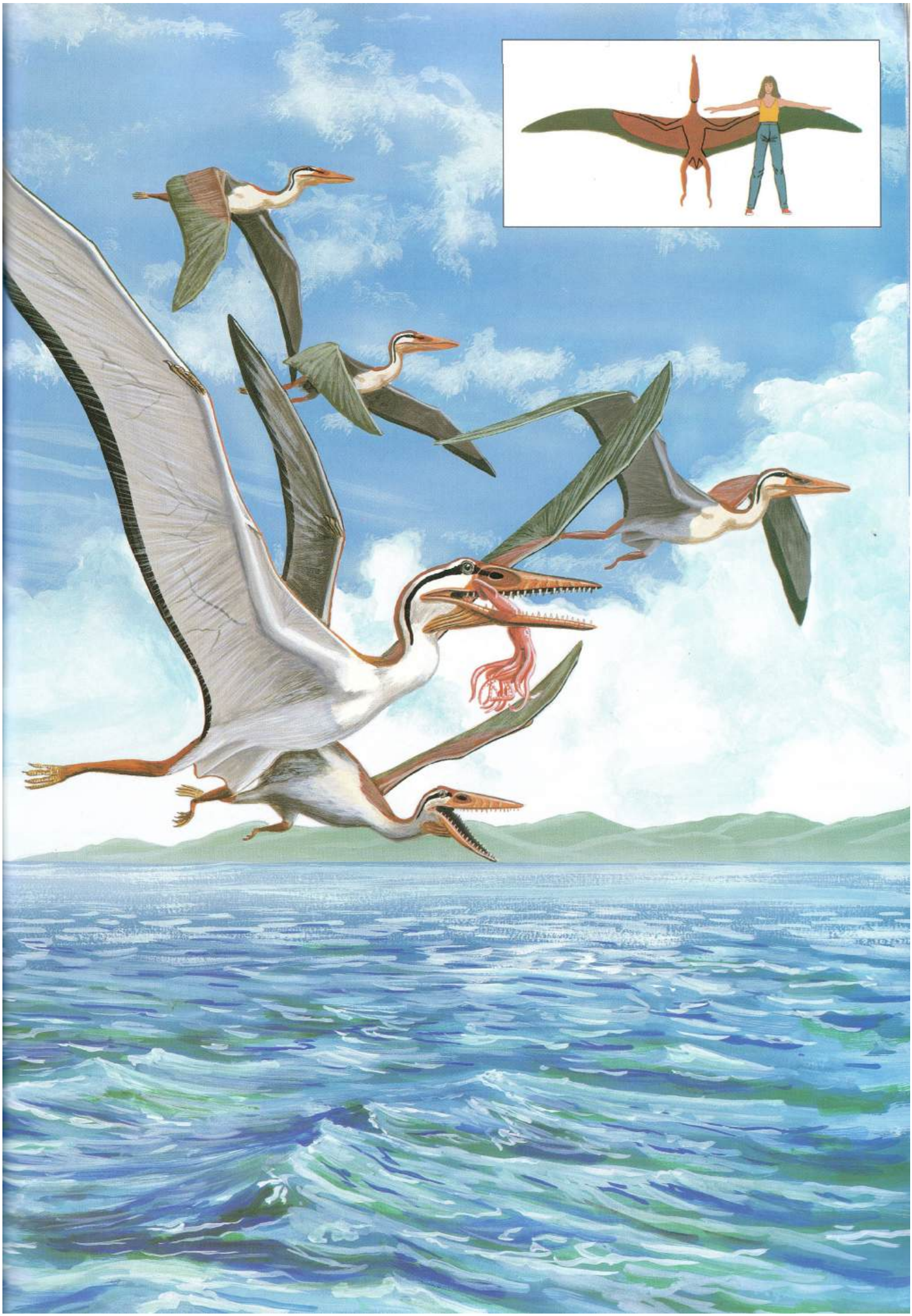
Joan Wiffen has also found parts of the wing bones of a pterosaur [TER-uh-SAW]. These were the first animals other than insects to fly. The wing was a membrane of skin, like a bat's wing, but spread from only one finger (the very long fourth one) to the side of the body. The first pterosaurs took to the air over 200 million years ago, and they were most common between about 150 and 100 million years ago. By the time of the New Zealand pterosaur, they were becoming rarer, their place being taken by birds.

Early pterosaurs were normally fairly small, often with long tails. Later ones were much larger, and had short tails. Some had amazing crests of bone on their heads, most had teeth, but several were toothless. We do not know what the head of the New Zealand pterosaur looked like, but we can guess that it would have been of the short-tailed sort. We also can work out that it would have had a wingspan of about four metres.

This fossil, too, was found in marine sediments, but this is not surprising. Throughout the world, pterosaur remains are usually found near ancient oceans or lakes, so these flying reptiles probably fed on fish or squid, like modern gannets, albatrosses or frigate birds. They may not have come ashore for days on end. They probably nested in huge cliff-top colonies, where there was a convenient precipice to jump off when they wanted to fly.

Warm-blooded pterosaurs

- In 1971, a fossil pterosaur was discovered in Russia that showed the imprint of dense fur on its body.
- It is now thought that all pterosaurs were covered in fur to keep them warm.
- This means that, unlike modern reptiles, but like mammals and birds, pterosaurs must have been warm-blooded.

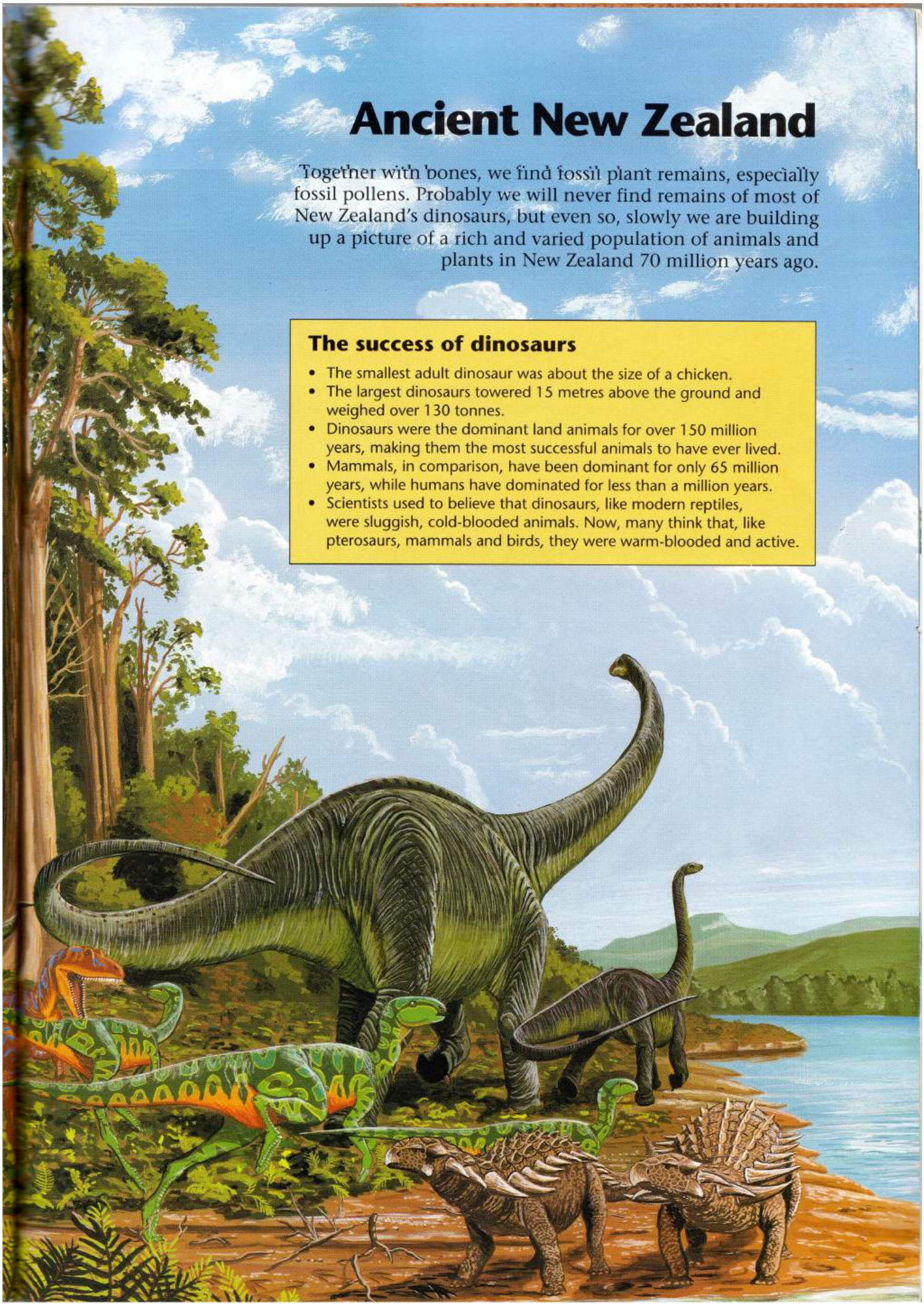


Ancient New Zealand

Together with bones, we find fossil plant remains, especially fossil pollens. Probably we will never find remains of most of New Zealand's dinosaurs, but even so, slowly we are building up a picture of a rich and varied population of animals and plants in New Zealand 70 million years ago.

The success of dinosaurs

- The smallest adult dinosaur was about the size of a chicken.
- The largest dinosaurs towered 15 metres above the ground and weighed over 130 tonnes.
- Dinosaurs were the dominant land animals for over 150 million years, making them the most successful animals to have ever lived.
- Mammals, in comparison, have been dominant for only 65 million years, while humans have dominated for less than a million years.
- Scientists used to believe that dinosaurs, like modern reptiles, were sluggish, cold-blooded animals. Now, many think that, like pterosaurs, mammals and birds, they were warm-blooded and active.



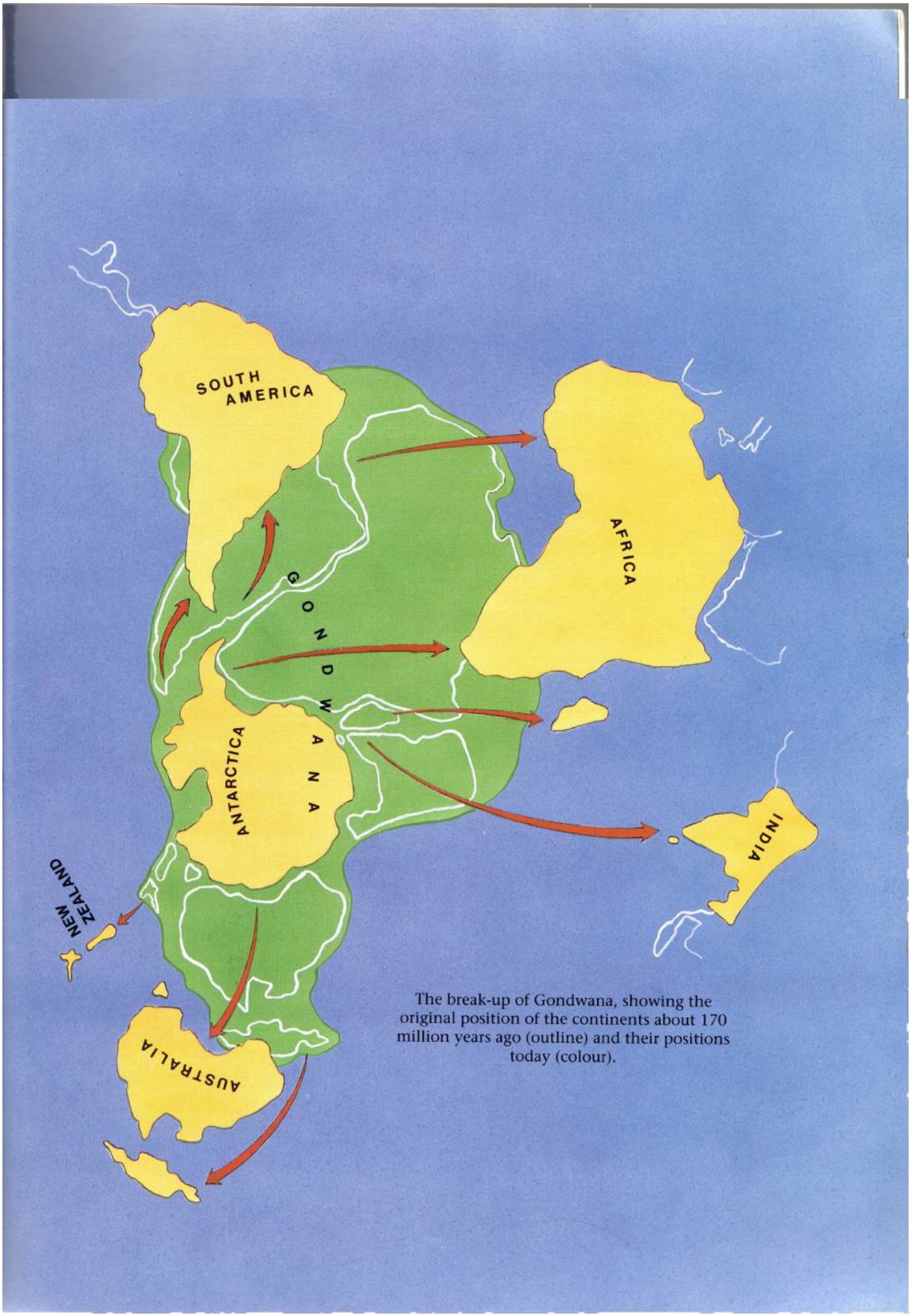
Gondwana

How did these dinosaurs get to New Zealand? They could not swim that far, and they certainly could not fly.

Well, New Zealand has not always been an island. You remember at the beginning we said that Australia and Antarctica were once joined together, but Africa, India and South America were giant islands? About 100 million years before that, all these continents were joined together into one huge supercontinent we call Gondwana. And attached to one edge, just in the corner between Australia and Antarctica, was New Zealand.

So animals such as dinosaurs could get anywhere on Gondwana simply by walking there!

Then this huge continent began to break up. Africa and South America were the first to go, taking their dinosaurs with them. New Zealand became an island about 80 million years ago. Much later, long after the dinosaurs had vanished, Australia and Antarctica split up, about 40 million years ago.



The break-up of Gondwana, showing the original position of the continents about 170 million years ago (outline) and their positions today (colour).

Why did the dinosaurs die?

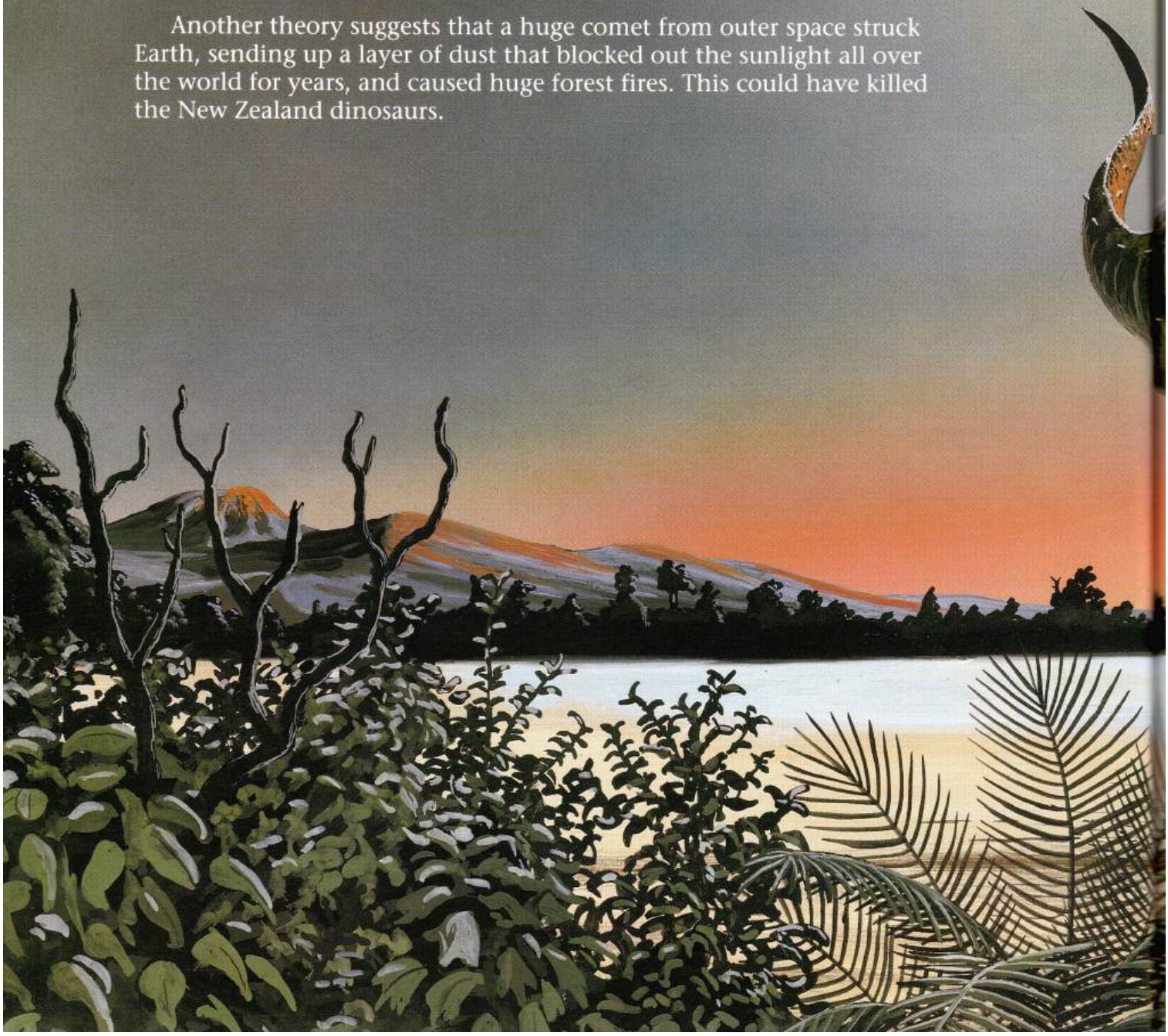
But although they were separated from their relatives in other lands, New Zealand's dinosaurs still died out, when the others did, about 65 million years ago.

We do not know why they died out but, now that we know that remote New Zealand had dinosaurs, we can dismiss some theories that have been suggested.

For example, it has been suggested that they died because the vegetation the plant-eaters fed upon changed, but we know the vegetation of New Zealand did not change. Mammals have been blamed for killing the dinosaurs, but there were no mammals in New Zealand.

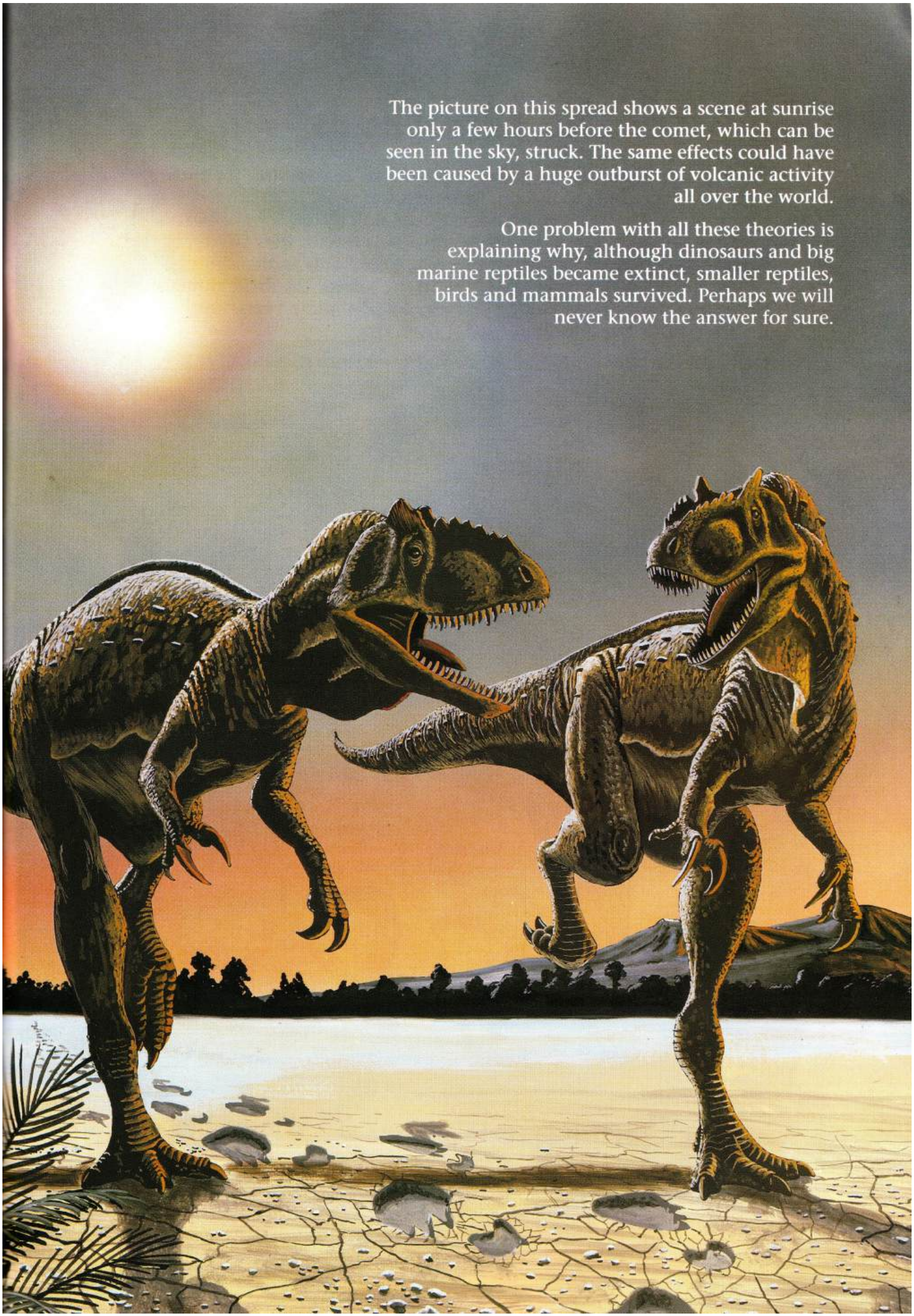
Others have suggested that rapid changes in the climate, caused by mountain building and changes in sea level, made life too difficult for the dinosaurs. This may have affected New Zealand too, but it seems surprising that it should have killed all the dinosaurs.

Another theory suggests that a huge comet from outer space struck Earth, sending up a layer of dust that blocked out the sunlight all over the world for years, and caused huge forest fires. This could have killed the New Zealand dinosaurs.



The picture on this spread shows a scene at sunrise only a few hours before the comet, which can be seen in the sky, struck. The same effects could have been caused by a huge outburst of volcanic activity all over the world.

One problem with all these theories is explaining why, although dinosaurs and big marine reptiles became extinct, smaller reptiles, birds and mammals survived. Perhaps we will never know the answer for sure.



After the dinosaurs

After the dinosaurs had gone, they left New Zealand free for birds and small reptiles to live on. Because it was so far from other countries, mammals could not get here, unless they flew or swam. The only mammals to make the trip across the sea were two types of bat, while seals and dolphins, some found only in this country, came to live around the coast. But in the forests, the main animals were birds. And it remained that way for 65 million years, until humans arrived only about 1,000 years ago.

All the birds on this page have died out since that time.

MOA

Eleven different types
Height at hip: 70 centimetres–1.9 metres
Weight: 20–250 kilograms

NEW ZEALAND PELICAN

Length: 2 metres
(slightly larger than
modern Australian pelican)

GREAT EAGLE

Length: 1.3 metres
Wingspan: 2–3 metres
Weight: 9–13 kilograms
(largest eagle in the world)

NEW ZEALAND SWAN

Length: 1.5 metres
(half as big again
as modern black swan)

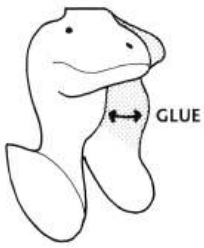
ADZEBILL

Height: 80 centimetres
Weight: 10 kilograms

Three models to cut out and make

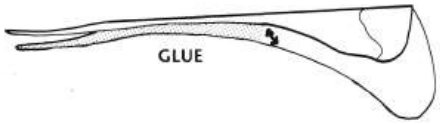
On the next three pages are some prehistoric reptiles you can cut out and make. The pterosaur and plesiosaur should be hung on threads, perhaps from the lampshade in your room; the dinosaur will stand on your desk or window ledge. The dinosaur is the most difficult to make. It might be best to do it last, after you have practised on the others.

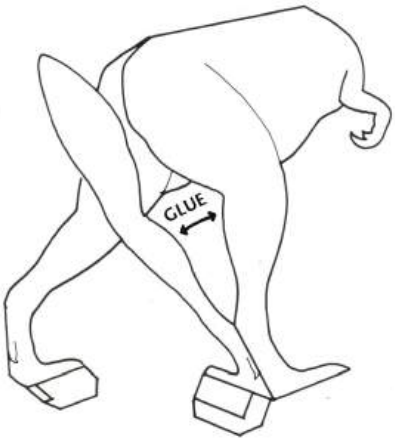
To make the models you will need scissors and glue. First, carefully cut the pages out of the book — be sure to leave enough paper behind to stop the book falling apart! Now carefully cut out and fold the pieces. Then, when you are sure you have got it right, put on the glue and press them together. Do not use too much glue — a spot here and there is enough. Use the diagrams (where areas to be glued have been shaded) to help you.



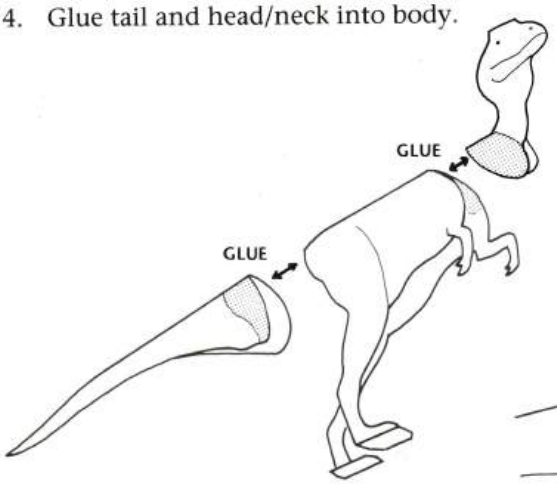
To make the dinosaur:

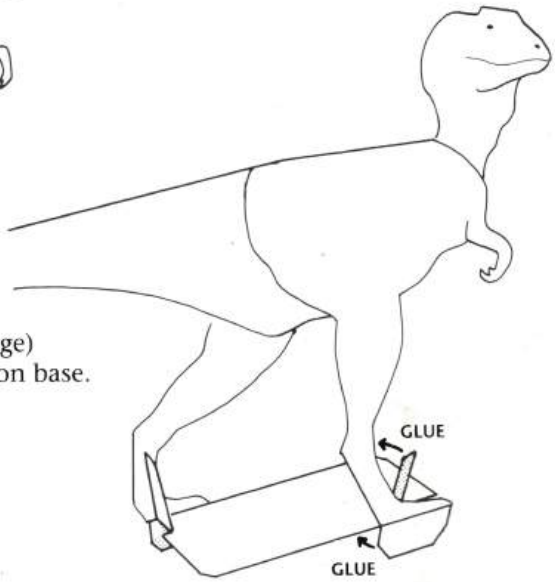
1. Glue head and neck, *but not shoulders*, together.
2. Glue back two-thirds of tail together.



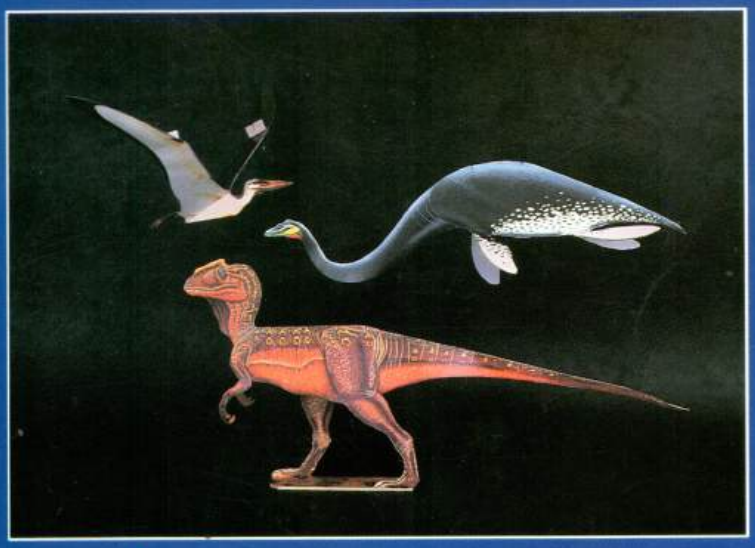


3. Fold inside of each leg to outer leg and glue. *Do not glue the sides of the body together.*
4. Glue tail and head/neck into body.





5. Glue dinosaur to base (on pterosaur page) using flaps on feet, and support struts on base.
6. Glue the base to some cardboard, cut to the same size or larger.
7. Curve the tail to the right to help the model balance.



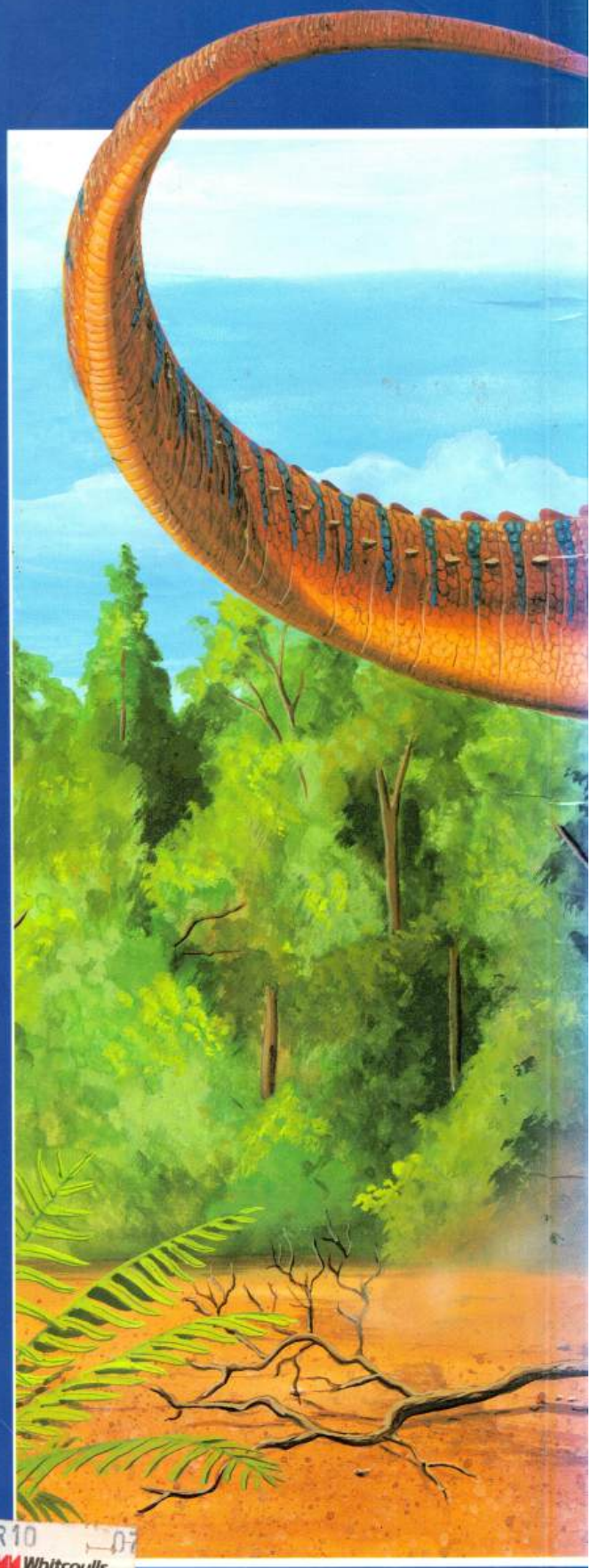
Sixty-five million years ago carnivorous dinosaurs roamed through the forests of New Zealand, running down and killing their gigantic plant-eating relatives. Pterosaurs swooped on huge leather wings over the sea where crocodile-like mosasaurs and long-necked plesiosaurs swam.

Dinosaurs, plesiosaurs, mosasaurs and pterosaurs are the spectacular reptiles of New Zealand's distant past — brought to life in this book.

An exciting, up-to-date account of New Zealand's prehistoric past for younger readers:

- Describes the finds of early fossil-hunters
- Traces the discovery of New Zealand's first dinosaur
- Why did the dinosaurs die out?
- Make your own dinosaur!

Make your own dinosaur, pterosaur and plesiosaur from the cut-out models in this book. Use only scissors and glue.



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